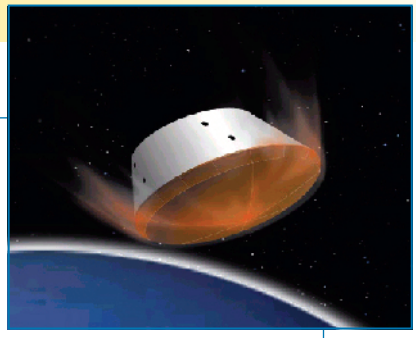
Advanced Space Transportation Technology Summary



Aerocapture

The majority of technologies now being pursued by NASA's In-Space Propulsion Program are concerned with increasing vehicle thrust and acceleration — boosting velocity to improve trip times for scientific missions to our neighboring worlds.

One key In-Space Propulsion technology research area, however, seeks to put the brakes on.

Researchers at five NASA Field Centers are working together to develop ways to decelerate spacecraft at their destinations, dropping them into long-duration orbits and even assisting with landing procedures — without the need for the heavy on-board fuel loads that historically have inhibited vehicle performance, mission duration and mass available for science payloads.

Aerocapture — the use of a planet's atmosphere to slow down a spacecraft — is part of a unique family of "aeroassist" technologies that will enable robust science missions to the most distant planets in our solar system. An aerocapture vehicle approaching a planet on a hyperbolic trajectory is "captured" into orbit as it passes through the atmosphere, without the use of on-board propulsion. This fuel-free method could reduce the typical mass of an interplanetary spacecraft by half or greater, allowing for a smaller, cheaper vehicle — one better equipped to conduct robust, long-term science at its destination.

To aerocapture, a spacecraft requires adequate drag to slow its speed and some protection from the heating environment. These two functions can be fulfilled in a variety of ways, including a traditional blunt, rigid aeroshell, such as that used during the Mars Pathfinder entry and descent in 1997; by a potentially lighter, inflatable aeroshell; or by a large, trailing "ballute," a combination parachute and balloon made of durable, thin material and stowed behind the vehicle for deployment.

In summer of 2002, NASA announced the selection of six research organizations to lead key hardware development: NASA's Langley Research Center in Hampton, Va., tasked with development of high-temperature composite structures; Applied Research Associates, Inc. of Englewood, Colo., tasked with development and testing of lightweight thermal protection system ablators; NASA's Ames Research Center at Moffett Field, Calif., tasked with characterizing advanced thermal protection systems; Ball Aerospace Corp. of Boulder, Colo., tasked with trailing ballute analysis and development; ELORET Corp. of Sunnyvale, Calif., tasked with development of advanced heatshield instrumentation; and Lockheed Martin Astronautics of Denver, tasked with aeroshell development and integration.

Aerocapture technologies and system requirements now under investigation by NASA and its partners span a broad spectrum of mission needs. In addition to design and testing of ballutes and other aerocapture systems themselves, flight vehicles also are being studied to determine how the use of aerocapture technologies impact vehicle aerodynamics, heat shielding and on-board guidance and control.

Potential near- and mid-term mission candidates for aerocapture technologies include support for NASA's planned Mars Exploration Program, which could launch research probes to our nearest neighboring world in the next decade; a potential mission to place a long-duration scientific orbiter around Neptune, the eighth planet; and a potential explorer mission to Titan, the 15th and largest of Saturn's known moons.

Aerocapture research is part of NASA's In-Space Propulsion Program, which is managed by the Office of Space Science in Washington, D.C., and implemented by the Marshall Space Flight Center. NASA's aeroassist technology development team includes Langley Research Center, Ames Research Center; the Jet Propulsion Laboratory in Pasadena, Calif.; Johnson Space Center in Houston, Texas; and the Marshall Center.

For more information about NASA's In-Space Propulsion Program and aerocapture research, visit:
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